DYNAMIC PAPER CHEMISTRY JAR^{tm}
&
HAND-SHEET MOLD

OPERATING MANUAL

Supplied By:

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I. INTRODUCTION

A. History

The **Dynamic Paper Chemistry Jar**^{tm} (DPCJ^{tm}) was developed to satisfy an urgent need for laboratory testing which by incorporating dynamic "real world" conditions into its methodology provided meaningful, useful data. The DPCJ^{tm} owes its origin to the Britt "Dynamic Drainage Jar" which, when first introduced by Ken Britt, provided a major breakthrough in paper chemistry laboratory test methods. It has been widely used to study retention under dynamic and turbulent conditions which simulate the paper machine and to correlate the laboratory test results with machine performance. Retention, however, is only one of several key parameters which should be studied under conditions of shear and turbulence.

Despite Britt's claim that the "Dynamic Drainage Jar" could not be used as a drainage measurement device, Paper Chemistry Laboratory, Inc. began experimenting with it as an alternative to the "static" Canadian Standard Freeness tester. The results, published in Paper Trade Journal (April 15, 1979), showed that the 30 Second Dynamic Drainage Test is more sensitive than the conventional Canadian Standard Freeness (CSF) drainage measurement. In the years that have transpired since the publication of this data we have modified the design of the instrument, revised and improved the procedures to achieve a greater degree of reproducibility and, most importantly, expanded the applications of the jar to include handsheet preparation, water removal efficiency and machine felt plugging/conditioning.

However, simply providing an instrument and set of procedures would be a disservice because more important is putting the data collected to good use in understanding and improving the system. For that reason we have expanded and updated our Operating Manual to better enable the paper chemist to design a comprehensive laboratory process development program.

We are actively engaged in further improving the DPCJ^{tm} and in both refining and further increasing the number of available test methods.

John G. Penniman
President

Carmel, N.Y.

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II. GENERAL INFORMATION

A. DESCRIPTION OF OPERATION

The papermaking system comprises a highly complex and dynamic series of interdependent processes. Unfortunately, even the slightest change in chemistry can affect the entire system. This makes the paper machine an expensive place to experiment with new chemicals or even make changes in dosage or addition point of existing chemicals. The balancing of the chemistry must first be done in the laboratory. However, the traditional methods of laboratory handsheet preparation give handsheets which are:

1. Not representative of the papermaking system because they are not made under dynamic conditions which include shear or turbulence.

2. Not representative of the process chemistry because the furnish is greatly diluted immediately prior to web formation.

3. Limited in scope because one is not able to collect drainage, retention or important electrokinetic data.

For these reasons, the **Dynamic Paper Chemistry Jar^{tm}** was developed as a tool to provide the paper chemist with the most information possible, while incorporating the dynamic conditions of the real world. In addition, the DPCJ^{tm} was designed to be easy to use, require a minimum of space; and be portable for convenient use at mill trials.

The DPCJ^{tm} consists of a vaned plexiglass jar and base separated by a wire mesh screen and a support screen. The base of the jar has an easily manipulated valve to control the flow of fluid from the jar. A 2-1/2 inch variable speed impeller is positioned in the jar just above the screen. The combination of the vanes in the jar and the action of the impeller provides are producible degree of shear and turbulence. This is particularly important in systems which employ high molecular weight flocculants which are subject to acission and break down under shear. The turbulence/shear also provides realistic First Pass Retention data in systems using filler. The amount of furnish and its consistency may be varied so as to correspond to machine headbox consistency or, alternatively, to provide a handsheet of pre-determined basis weight. 500 ml is the minimum amount of furnish which is required for reproducible 30 Second Dynamic Drainage experiments.

B. PROCEDURE FOR GENERAL USE OF THE DPCJ^{tm}

A sample of furnish is poured into the jar and mixed at a set predetermined speed. When using the Mark III jar base, the drain valve is opened. After 30 seconds, the valve is closed. The amount of fluid or "white water" collected during the 30 seconds represents the Dynamic Drainage parameter. Its volume is measured using a graduated

cylinder. The residual Dynamic Drainage fluid may then be used to measure a variety of parameters including First Pass Retention, mobility/zeta potential, specific conductance, temperature, pH and pitch count.

When using the Mark IV jar base to make dynamic handsheets, a sample furnish is poured into the jar. After mixing at a series of set predetermined speeds, and with the impeller still mixing the remaining furnish sample, a laboratory vacuum pump and vacuum collection flask is attached to the jar via the drainage valve. When the vacuum pump reaches constant pressure, the valve is opened and the remaining water is vacuumed from the jar through the pad which has formed on the screen.

The jar may be easily opened to remove the resulting pad. The consistency of the pad may then be determined as a measure of the ease of water removal. We have shown that this parameter correlates closely to Water Retention Value as determined by centrifugation.

Alternatively, the pad may be removed and processed as a "dynamic" handsheet. The sheet is pressed, dried and conditioned according to TAPPI standards or specific lab procedures. Rings are optionally available to hold the sheets taut and permit ventilation for drying and temperature/humidity conditioning. The handsheet may then be used to measure any one of a large number of physical strength or optical properties.

Dyanamic handsheets of four times the area are produced on the **Dynamic Paper Chemistry Jar^{tm} Mark V** using the same general procedure.